WE CLAIM:

1. A method of monitoring cross-talk, at a point in an optical system, in a multiplexed optical signal having a plurality of channels upon one or more of which has been impressed, at another point in the optical system, a unique dither, the method comprising:

determining channel power of at least one channel of the plurality of channels;

determining a fractional power of any dither present upon the at least one channel; and

determining a power transfer coefficient from the fractional power and the channel power of the at least one channel.

2. A method according to claim 1 wherein the power transfer coefficient is determined from an equation $\beta_{ij} = (\beta_{ij}P_j)/P_j$ wherein β_{ij} is the power transfer coefficient, P_j is the power of a channel, j, corresponding to the at least one channel and $\beta_{ij}P_j$ is the fractional power of a dither, i, corresponding to the dither present upon the at least one channel.

3. A method of controlling output characteristics of the multiplexed optical signal comprising the method of claim 1 and further comprising providing instructions for controlling the power transfer coefficient.

4. A method of determining a channel power of a multiplexed optical signal having a plurality of channels wherein one or more unique dithers are each impressed upon a respective channel of the plurality of channels, the method comprising:

determining at a designated co-location point of a plurality of co-location points a channel power of the plurality of channels and a fractional power of each one of the one or more unique dithers present upon each one of the plurality of channels;

determining power transfer coefficients from the fractional power and the channel power of the plurality of channels;

determining, at at least one other co-location point, the power of the one or more unique dithers;

summing respective contributions to the channel power of at least one of the plurality of channels, at the at least one other co-location point; and

determining the respective contributions to the channel power, at the at least one other co-location point, from the power transfer coefficients and the power of the one or more unique dithers at the at least one other co-location point.

5. A method of measuring channel power of a multiplexed optical signal having a plurality of channels wherein one or more unique dithers are each impressed upon a respective channel of the plurality of channels, the method comprising:

determining, at a designated co-location point of a plurality of co-location points, inverse power transfer coefficients, β'_{ji}, of a matrix $[\beta']$;

determining, at at least one other co-location point, a power, AM_i, of the one or more unique dithers wherein the power, AM_i, forms components of a vector $[AM]$; and

calculating at least one of a channel power, P_j, of the plurality of channels, at the at least one other co-location point using $[P]=[\beta'][AM]$ wherein $[P]$ is a vector with components corresponding to the channel power, P_j, at the at least one other co-location point.

6. A method according to claim 5 further comprising determining the power, AM_i, of the one or more unique dithers at the designated co-location point.

7. A method according to claim 5 wherein the determining, at a designated co-location point of a plurality of co-location points, inverse power transfer coefficients, β'_{ji}, comprises:

determining, at the designated co-location point, the channel power, P_j, of the plurality of channels;

determining, at the designated co-location point, a fractional power, $\beta_{ij}P_j$, of a dither, i, of the one or more unique dithers, present upon a channel, j, of the plurality of channels, wherein β_{ij} corresponds to power transfer coefficients;

calculating the power transfer coefficients, β_{ij}, from information on the channel power, P_j, at the designated co-location point and the fractional power, $\beta_{ij}P_j$, and using $\beta_{ij} = (\beta_{ij}P_j)/P_j$; and

calculating the inverse power transfer coefficients, β'_{ji}, through inversion of a matrix $[\beta]$ comprising the power transfer coefficients, β_{ij}, as matrix elements and obtaining the inverse matrix $[\beta']$.

8. A method according to claim 5 wherein the channel power, P_j, and the inverse power transfer coefficients, β'_{ji}, have complex values and wherein channel power is determined by taking an absolute value of the channel power, P_j.

9. A method according to claim 5 applied to a multiplexed optical signal in which transfer of dithers from any one of its channels to any other one of its channels is due to stimulated Raman scattering (SRS).

10. A method according to claim 5 applied to a multiplexed optical signal having at least one its channels impressed with a plurality of dithers to provide wave identification (WID) information.

11. A method according to claim 5 comprising determining new values for the inverse transfer coefficients, β'_{ji}, at periodic intervals.

12. A method of controlling output characteristics of the multiplexed optical signal comprising the method of claim 5 and further comprising providing instructions to at least one of a plurality of basic functional components in response to fluctuations in at least one of the channel power, P_j, and channel count of the optical signal at at least one of an input and the plurality of co-location points.

13. A method of controlling output characteristics of the multiplexed optical signal comprising the method of claim 7 and further comprising providing instructions to at least one of a plurality of basic functional components in response to fluctuations in the power transfer coefficients, β_{ij}, of the matrix $[\beta]$ at one or more of the plurality of co-location points.

14. A method of wavelength division multiplexed (WDM) channel tagging and monitoring of a multiplexed optical signal having a plurality of channels wherein one or more unique dithers are each impressed upon a respective channel of the plurality of channels, the method comprising:

determining values of inverse power transfer coefficients β'_{ji}, of a matrix $[\beta']$, at a designated co-location point of a plurality of co-location points;

receiving a portion of the multiplexed optical signal from at least one other co-location point and determining a power, AM_i, of the one or more unique dithers wherein the power, AM_i, forms components of a vector $[AM]$; and

calculating a channel power, P_j, of at least one of the plurality of channels of the multiplexed optical signal at the at least one other co-location point using $[P]=[\beta'][AM]$ wherein $[P]$ is a vector with components corresponding to the channel power, P_j, at the at least one other co-location point.

15. An optical apparatus adapted to monitor cross-talk, at a point in an optical system, in a multiplexed optical signal having a plurality of channels upon one or more of which has been impressed, at another point in the optical system, a unique dither, the apparatus comprising:

an OSA (Optical Spectrum Analyzer) adapted to measure an indicator of channel power of at least one channel of the plurality of channels and to measure an indicator of a fractional power of any dither present upon the at least one channel; and

a control circuit adapted to determine a power transfer coefficient from the fractional power and the channel power of the at least one channel.

16. An optical apparatus applied to a multiplexed optical signal having a plurality of channels wherein one or more unique dithers are each impressed upon a respective channel of the plurality of channels, the apparatus comprising:

an OSA adapted to receive a portion of the multiplexed optical signal from a designated co-location point of a plurality of co-location points;

at least one dither detector adapted to receive a portion of the multiplexed optical signal from a respective other one of the co-location points, the at least one dither detector further adapted to measure an indicator of a power, AM_i, of the one or more unique dithers;

a control circuit connected to the OSA and to the at least one dither detector wherein the control circuit is adapted to calculate inverse power transfer coefficients, β'_{ji}, from information on the multiplexed optical signal, at the designated co-location point, obtained from the OSA and to calculate a channel power, P_j, of the plurality of channels for at least one of the plurality of channels at the respective other one of the co-location points based on information associated with the power, AM_i, of the one or more unique dithers at the respective other one of the co-location points and based on the inverse power transfer coefficients, β'_{ji}.

17. An apparatus according to claim 16 further comprising an additional dither detector adapted to receive a portion of the multiplexed optical signal from the designated co-location

point and adapted to measure an indicator of the power, AM_i, of the one or more unique dithers.

18. An apparatus according to claim 16 wherein the OSA is adapted to measure, from the portion of the optical signal received from the designated co-location point, an indicator of a fractional power, $\beta_{ij}P_j$, of a dither, i, of the one or more unique dithers present upon a channel, j, of the plurality of channels.

19. An apparatus according to claim 18 wherein the OSA is further adapted to measure, from the portion of the optical signal received from the designated co-location point, an indicator of the channel power, P_j, of the plurality of channels.

20. An apparatus according to claim 19 wherein the indicator of the fractional power, $\beta_{ij}P_j$, and the indicator of the channel power, P_j, are voltages and one of the OSA and the control circuit is adapted convert the voltages into powers.

21. An apparatus according to claim 16 wherein the indicator of the power, AM_i, is a voltage and one of the at least one dither detector and the control circuit is adapted convert the voltage into a power.

22. An apparatus according to claim 16 wherein the OSA comprises:

a demultiplexer (DeMUX) adapted to demultiplex the portion of the multiplexed optical signal received from the designated co-location point;

an electrical switch connected to the DeMUX through a plurality of parallel paths such that each path carries a de-

multiplexed optical signal associated with a respective channel of the portion of the multiplexed optical signal received from the designated co-location point; and

a photo-detector within each one of the parallel paths and adapted to convert a respective one of the de-multiplexed optical signals into an electrical signal; wherein

the electrical switch is adapted to sequentially output, at a single output, the electrical signals.

23. An apparatus according to claim 16 wherein the OSA comprises a wavelength tunable filter adapted to sequentially filter through channels of the portion of the multiplexed optical signal received from the designated co-location point.

24. An apparatus according to claim 16 wherein the OSA and the at least one dither detector each comprise at least one photo-detector adapted to convert a respective optical signal into an electrical signal.

25. An apparatus according to claim 16 wherein the OSA and the at least one dither detector each comprise at least one electrical amplifier adapted to amplify electrical signals associated with the portion of the multiplexed optical signal received from the designated co-location point.

26. An apparatus according to claim 16 wherein the OSA and the at least one dither detector each comprise at least one analog-to-digital converter (ADC) adapted to convert a respective electrical signal into a digital signal.

27. An apparatus according to claim 18 wherein the at least one dither detector and the OSA each comprise an electrical spectrum analyzer adapted to measure the indicator

of the power, AM_i, and the indicator of the fractional power, $\beta_{ij}P_j$, respectively.

28. An apparatus according to claim 27 wherein the electrical spectrum analyzers are digital signal processors (DSPs).

29. An apparatus according to claim 16 wherein the control circuit is further adapted to provide instructions to at least one basic functional component for controlling characteristics of the multiplexed optical signal at an output in response to fluctuations in any one or more of the channel power, P_j, channel count of the multiplexed optical signal and changes in the inverse power transfer coefficients, β'_{ji}, at at least one of an input and the co-location points.

30. An apparatus according to claim 16 comprising at least one additional OSA adapted to receive a portion of the multiplexed optical signal from a respective co-location point of the plurality of co-location points and wherein the control circuit is adapted to determine a value of the inverse power transfer coefficients, β'_{ji}, at the respective co-location point from information on the multiplexed optical signal, at the respective co-location point, obtained from the least one additional OSA.

31. An apparatus according to claim 16 comprising at least one additional dither detector adapted to receive a portion of a reflected portion of the multiplexed optical signal from a respective one of the co-location points and adapted to measure the indicator of the power, AM_i, of dithers of the reflected portion of the multiplexed optical signal, whereby the power, AM_i, of the dithers of the reflected portion

of the multiplexed optical signal is adapted to calculate the channel power, P_j, of channels of the reflected portion of the multiplexed optical signal.

32. An apparatus according claim 16 applied to a multiplexed optical signal wherein at least one channel of the plurality of channels having impressed a unique dither comprises at least one additional unique dither to provide WID.

33. An optical apparatus applied to a multiplexed optical signal having a plurality of channels wherein one or more unique dithers are each impressed upon a respective channel of the plurality of channels, the apparatus comprising:

an OSA connected at a designated co-location point of a plurality of co-location points;

at least one dither detector connected to a respective other one of the co-location points, the at least one dither detector adapted to measure an indicator of a power, AM_i, of the one or more unique dithers;

a control circuit connected to the OSA and to the at least one dither detector wherein the control circuit is adapted to calculate inverse power transfer coefficients, β'_{ji}, from information on the multiplexed optical signal, at the designated co-location point, obtained from the OSA and to calculate a channel power, P_j, of at least one of the plurality of channels of the multiplexed optical signal at the respective other one of the co-location points based on information associated with the power, AM_i, of the one or more unique dithers at the respective other one of the co-location points and based on the inverse power transfer coefficients, β'_{ji}.

34. An apparatus according to claim 33 comprising a plurality of basic functional components which are optical devices.

35. A computer readable storage medium carrying code adapted to:

determine values, at a designated co-location point of a plurality of co-location points, of inverse power transfer coefficients, β'_{ji}, that are associated with a multiplexed optical signal having a plurality of channels wherein one or more unique dithers are each impressed upon a respective channel of the plurality of channels;

receive, from one or more of the plurality of co-location points, information associated with a power, AM_i, of the one or more unique dithers;

calculate a channel power, P_j, of at least one of the plurality of channels of the multiplexed optical signal at the one or more of the plurality of co-location points using the information associated with the power, AM_i, of the one or more unique dithers and the inverse power transfer coefficients, β'_{ji}.

36. A computer readable storage medium according to claim 35 further adapted to calculate, at periodic time intervals, new values of the inverse power transfer coefficients, β'_{ji}.

37. A computer readable storage medium according to claim 35 wherein the determining values, at a designated co-location point of a plurality of co-location points, of inverse power transfer coefficients, β'_{ji}, comprises:

receiving, from the designated co-location point, information associated with the channel power, P_j, of the plurality of channels of the multiplexed optical signal;

determining, from the channel power, P_j, at the designated co-location point, information associated with a fractional power, $\beta_{ij}P_j$, of a dither, i, of the one or more unique dithers present upon a channel, j, of the plurality of channels, wherein β_{ij} corresponds to power transfer coefficients;

calculating the power transfer coefficients, β_{ij}, from information on the channel power, P_j, and the fractional power, $\beta_{ij}P_j$;

calculating the inverse power transfer coefficients, β'_{ji}, through inversion of a matrix $[\beta]$ comprising the power transfer coefficients, β_{ij}, as matrix elements and obtaining an inverse matrix $[\beta']$ of which the inverse power transfer coefficients, β'_{ji}, are its matrix elements.

38. A computer readable storage medium according to claim 35 further adapted to provide instructions to at least one of a plurality of basic functional components for controlling characteristics of the multiplexed optical signal at an output in response to fluctuations in at least one of the channel power, P_j, and channel count of the multiplexed optical signal at at least one of an input and the co-location points.